AD_____

Award Number: W81XWH-11-1-0444

TITLE: Using Technology to Expand and Enhance Applied Behavioral Analysis Programs for Children with Autism in Military Families

PRINCIPAL INVESTIGATOR: Wayne Fisher, Ph.D.:

CONTRACTING ORGANIZATION: University of Nebraska Medical Center
Omaha, NE 68198-5450

REPORT DATE: July 2013

TYPE OF REPORT: Annual

PREPARED FOR: U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
1 Jul 2013	Annual	1 Jul 2012 - 30 Jun 2013

4. TITLE AND SUBTITLE

Using Technology to Expand and Enhance Applied Behavioral Analysis Programs for Children with Autism in Military Families

5a. CONTRACT NUMBER

5b. GRANT NUMBER
W81XWH-11-1-0444

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

Wayne W. Fisher, Cathleen C. Piazza, Michael E. Kelley,
Henry S. Roane, and Kevin C. Luczynski
wfisher@unmc.edu, cpiazza@unmc.edu, kelboat@gmail.com,
E-Mail oaneh@upstate.edu, and kevin.luczynski@unmc.edu

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS

University of Nebraska Medical Center
Omaha, NE 68198-5450

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY
U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for Public Release; Distribution Unlimited

13. SUPPLEMENTARY NOTES

Autism spectrum disorders (ASDs) are disorders that affect as many 1 in 88 children. Without intensive treatment, the long- term outcomes for children with an ASD remain bleak and are associated with a high divorce rate among parents. Interventions based on applied behavior analysis are well documented, but unfortunately these services are often not available to military-dependent children because of the lack of appropriately training individuals. This project will demonstrate how web- based technologies can increase the availability of this effective treatment. The second year of the award involved recruiting families with a child with an ASD and adults to serve as ABA tutors to initiate the technology-enhanced parent-training (Experiment 1) and tutor-training (Experiment 2) curricula as well as technology-enhanced early intervention services in family's homes (Experiment 3). The preliminary results for the parent-training and tutor-training curricula support the efficacy of the web-based teaching procedures. We are continuing to make progress toward recruiting and enrolling families in the parent-training and early-intervention experiments

15. SUBJECT TERMS
Applied Behavior Analysis, Autism, Parent Training, Telemedicine, Tutor Training

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			USAMRMC
U	U	U	UU	18	19b. TELEPHONE NUMBER *(include area code)*

Table of Contents

	Page
Introduction……..…..	**4**
Body……..	**5**
Key Research Accomplishments…….…….	**15**
Reportable Outcomes……	**16**
Conclusion……	**17**
References……	**18**

Introduction

Autism spectrum disorders (ASDs) are disorders of the brain that affect as many as 1 in 88 children. Without intensive and appropriate treatment, the long-term outcomes for children with ASDs remain bleak and are associated with a high divorce rate among parents and increased risk for mental health disorders among family members. The efficacy of and empirical support for interventions for ASDs based on applied behavior analysis (ABA) is well documented. Unfortunately, these services are often not available to military-dependent children because there are not enough appropriately trained individuals to design and provide ABA services. This project will demonstrate how web-based technologies can increase the availability of effective treatment for military-dependent children with ASDs. By evaluating a technology-enhanced treatment delivery model, military families will be able to receive empirically supported treatment services in a timely manner anywhere in the world. Also, training therapists to implement ABA programs using a web-based model will greatly increase the number of well-trained therapists in areas around many military bases.

Body

Task 2. Complete parent and tutor training and EIBI aims for 5 cohorts, which includes 50 participant families and their ABA tutors (timeframe, Months 12-44).

From Statement of Work*: Tasks include three distinct sub-tasks for each cohort. Our training protocol based on E-Learning using the latest web-based and televideo-based instruction will provide an efficient and effective mechanism for training military parents of children with autism anywhere in the world by experts in one location (University of Nebraska Medical Center in Omaha). These trained parents will then be able to implement effective behavior management and teaching strategies with high procedural integrity (90% accuracy). Second, we will use the protocol we developed to train adults to become ABA tutors and to implement early intervention procedures with high integrity (90% accuracy) in areas of the world where such services are unavailable. The training protocol (using web-based E-Learning instructional methods) will be the same for the parents and the ABA tutors, but they will have more extensive curricula (with the curriculum for the ABA tutors being more comprehensive). Third, we will evaluate changes in cognitive, language, social, play, and adaptive skills and decreases in problem behaviors among children with autism in military families who receive technology-enhanced early intervention services that are supervised by our experts. The children in the technology-enhanced early intervention treatment group will show significantly greater improvements than children randomly assigned to a waitlist-control group.*

In each cohort, there will be 10 children with autism recruited with at least one parent (cohort n => 10) and one ABA tutor (cohort n => 10) per child. In the first cohort, 5 of the children and their corresponding parents (n => 5) and ABA tutors (n => 5) will be randomly assigned to the technology-enhanced early intervention treatment group and the other 5 children and their corresponding parents (n => 5) and ABA tutors (n => 5) will be assigned to the waitlist-control group.

We have reported progress for the preliminary evaluations, Experiment 2, and Experiments 1 and 3 separately to improve the organization of the annual report.

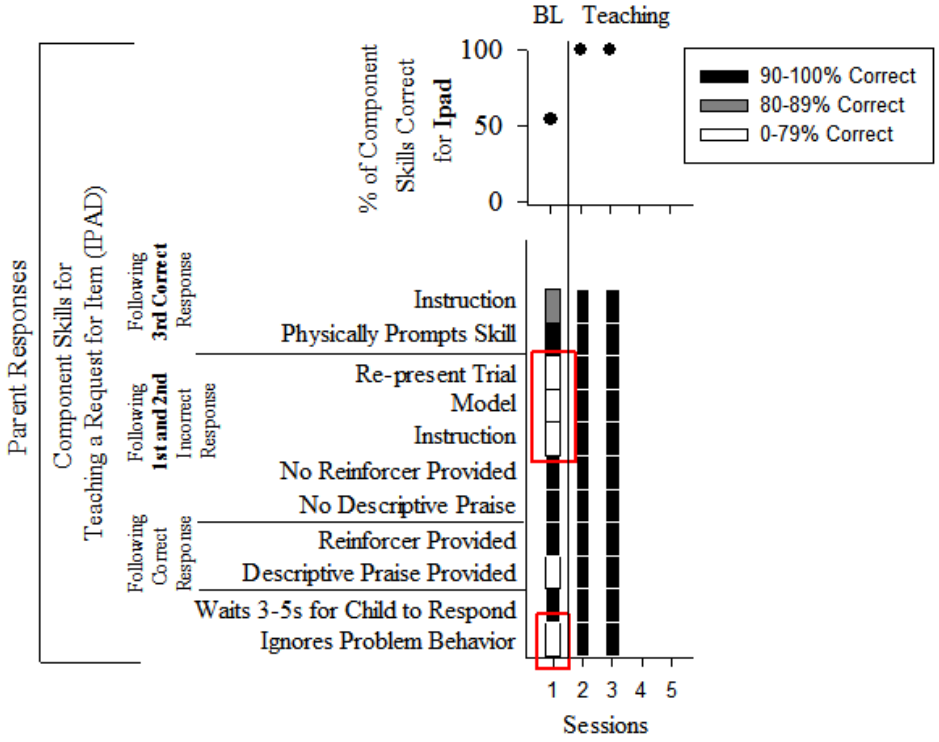
1. *Preliminary evaluations on the efficacy of the parent-training curriculum designed to teach parents in the technology-enhanced group (Experiment 1).*

   a. We evaluated our technology-enhanced parent-training procedures on teaching a parent how to increase her child's communication skills. Below is a graphical depiction of one parent's performance in learning how to teach their child to request a highly preferred item (i.e., access to an IPAD). The top panel depicts the parent's performance across all 11 skills (closed-circles plot) and the bottom panel depicts the parent's performance for each of the individual skills (black, gray, and white boxes denote accuracy levels of 90%, 80%, and below 79%, respectively).

      Prior to experiencing our training curriculum, the parent only exhibited about half of the target skills and did not correctly implement several critical teaching components following an incorrect response, which included providing instructions, modeling the correct response, practicing the skill with the child, and ignoring the child's problem behavior (these component skills with errors are highlighted by the red boxes).

After viewing our 60-min multimedia module on *Preventing Problem Behavior* and participating in scripted role-play sessions with an expert, a robust improvement in the parent's performance was observed during the first post-test assessment (session 2) and this improvement was maintained across a second post-test assessment (session 3).

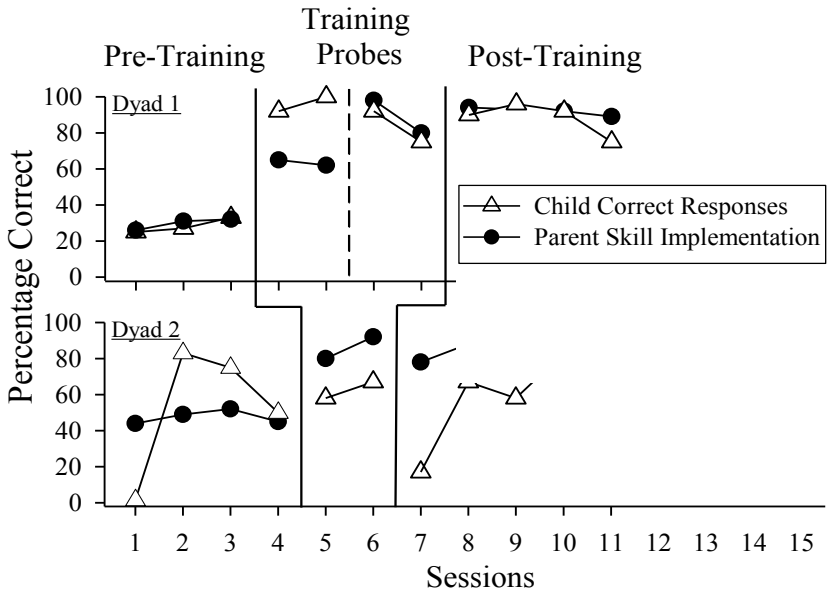
Figure 1.



b. We also evaluated the parent-training procedures on teaching two parents to implement discrete trial training with their child. The data in Figure 2 below shows the relation between parents' accuracy of implementing the teaching strategies as designed (i.e., procedural integrity) and their child's learning outcomes. In baseline, parents were asked to teach their child an expressive identification skill (e.g., stating the color of different items) using discrete trial training, based on written instructions of the procedures. On the y-axis is the percentage of teaching opportunities in which the parents' correctly implemented the teaching procedures and their child's correct responding. Both parents implemented only approximately one third (top panel; closed circles) to half (bottom panel; closed circles) of the teaching procedures correctly and, as a result, their child did not acquire the target skill (white triangles). Following our web-based training, in which the parent received real-time feedback on implementing discrete trial training, the percentage of opportunities with correct implementation of the procedures increased to above 60% for the parent in the top panel and 80% or above for the parent in the bottom panel. This led to an increase in their child's performance to nearly 100% accuracy and 60% accuracy in the top and bottom panels, respectively. After some additional training, the parent's accuracy in the top panel increased to above 80%. We observed maintenance of both parent and child performance during the post-training assessment. Experimental control over the effects of the training curriculum was shown using a multiple-baseline design

across parent-child dyads. These outcomes are examples of the efficacy and maintenance results we expect with parents in the randomized clinical trial as we continue to increase the number of participants enrolled.

Figure 2.



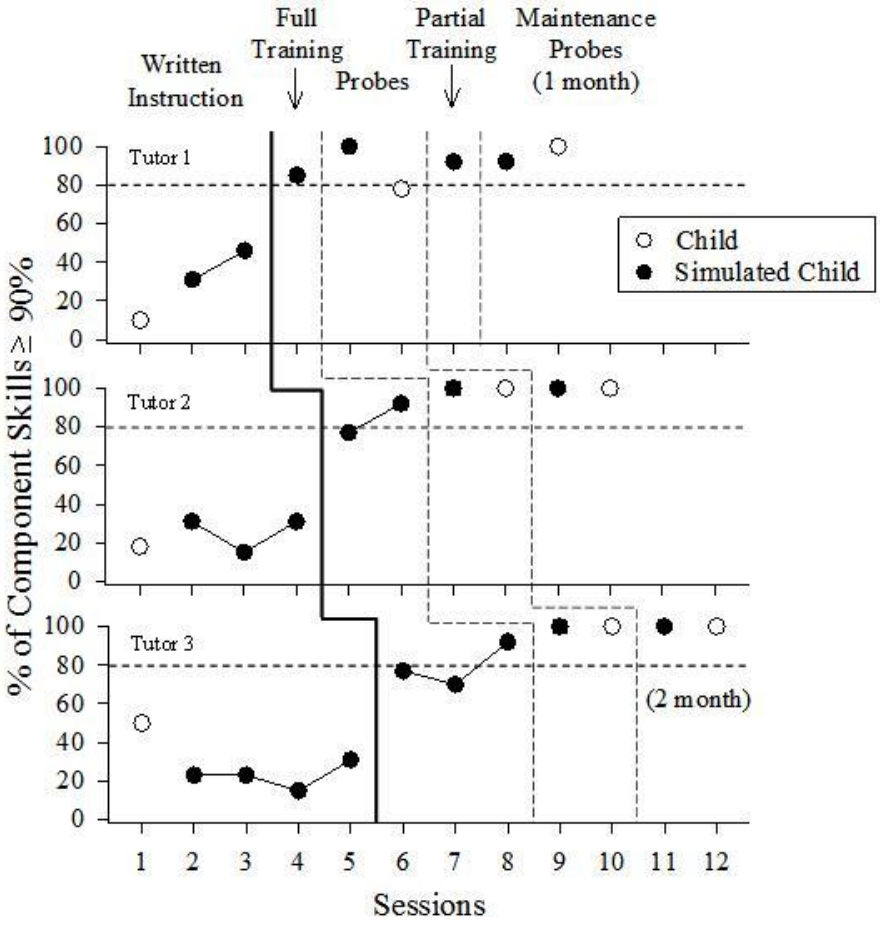
2. *Preliminary evaluation on the efficacy of the tutor-training curriculum designed to train ABA tutors in the technology-enhanced group (Experiment 2).*

We evaluated our tutor-training curriculum on teaching adult tutors how to conduct a standard preference assessment, which is commonly used to objectively identify children's preferences who exhibit limited communication abilities. Below in Figure 3 is a graphical depiction of three tutors' performance in learning how to accurately implement the 13 skills involved in conducting the preference assessment. Each panel represents a different tutor's performance, with respect to the percentage of component skills implemented with accuracy above 90%. The open circles denote sessions conducted with a child with ASD; the closed circles denote sessions conducted with a "simulated" child (i.e., an adult who exhibits child-like behaviors).

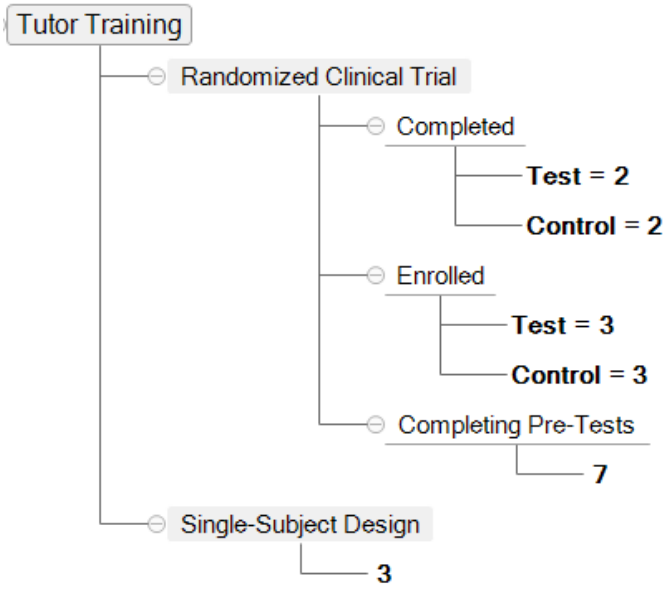
Prior to experiencing our training curriculum, the tutors were given written instructions on how to implement the preference assessment. All three participants performed at unsatisfactory levels with written instructions alone (i.e., below 50% accuracy). Next, we implemented our web-based training procedures, which involved the tutors viewing a 60-min multimedia module on *Preference Assessments* and participated in a scripted role-play session with one of our experts. After viewing the module and completing one role-play session, a notable increase in the percentage of component skills implemented accurately was observed for all three tutors. Experimental control over the effects of the training curriculum was shown using a multiple-baseline-across-subjects design.

After observing consistent performance, we conducted an additional probe with a "simulated" child and an actual child, and then provided one more session with additional training (Partial Training) on the few component skills that were more

difficult for the tutors to acquire. We then conducted two follow-up observations after a month and observed maintenance of the tutors' accuracy in implementing the preference assessment. These outcomes are examples of the efficacy and maintenance results we expect with other tutors during the randomized clinical trial. *Figure 3.*



3. *Recruit, pretest, and train 5 tutors in the technology-enhanced test group and 5 tutors in the waitlist-control group across two cohorts.* Schematic 1 details the progress for the technology-enhanced tutor-training evaluation (Experiment 2).
Schematic 1.



a. Randomized Clinical Trial. We have initial outcome data for the between-subjects comparison with two tutors randomized to the technology-enhanced group and two to the waitlist-control group. Currently, three randomly assigned tutors are progressing through the technology-enhanced training while three other tutors are in the waitlist-control group. We have enrolled 7 additional tutors who are at varying stages of completing the pre-tests prior to their randomization. In Figures 4 and 5, we present the initial outcome data and the results from preliminary statistical tests.

Dates are depicted on the x-axis, and the tutors assigned to the test and waitlist-control groups are depicted on the y-axis. The black and gray horizontal bars show the time to recruit each participant, obtain consent, and complete the pre-test assessments. After the pre-tests were completed, the participants were randomly assigned to either the test or waitlist-control group. The red circles denote the tutors' performance on one of our primary dependent measures, Behavioral Implementation Skills for Work Activities (BISWA), and the green squares denote the tutors' performance on our other primary dependent measure, Behavioral Implementation Skills for Play Activities (BISPA).

During the pretests for both measures, moderate to low levels of the component skills was observed for all tutors in Figures 4 and 5. For the tutors assigned to the technology-enhanced group (P006 & P009), the dates for completing the training modules and scripted role-plays sessions are denoted by the gray and black circles, respectively; during this time, the tutors (P003; P008) in the waitlist-control group did not experience the training curriculum. Following the tutors' completion of the 40-hour curriculum, we conducted a second BISWA and BISPA assessment (posttest). The participants in the test group improved from an average score of 57% correct on the BISWA on the pretest to an average score of 100% on the BISWA posttest, whereas the participants in the control group showed only a 1% improvement from the pretest to the posttest. On the BISPA, participants in the test group improved from an average score of 0% during the pretest to an average score of 100% during the posttest, whereas participants in the control group showed no improvement from pretest to posttest. The differences between the test and control groups approached statistical significance for the BISWA ($p = .066$) and the differences for the BISPA were highly significant ($p < .0001$). We anticipate that differences between the experimental and control groups will all be highly significant as more participants are added and our power to detect differences increases.

I

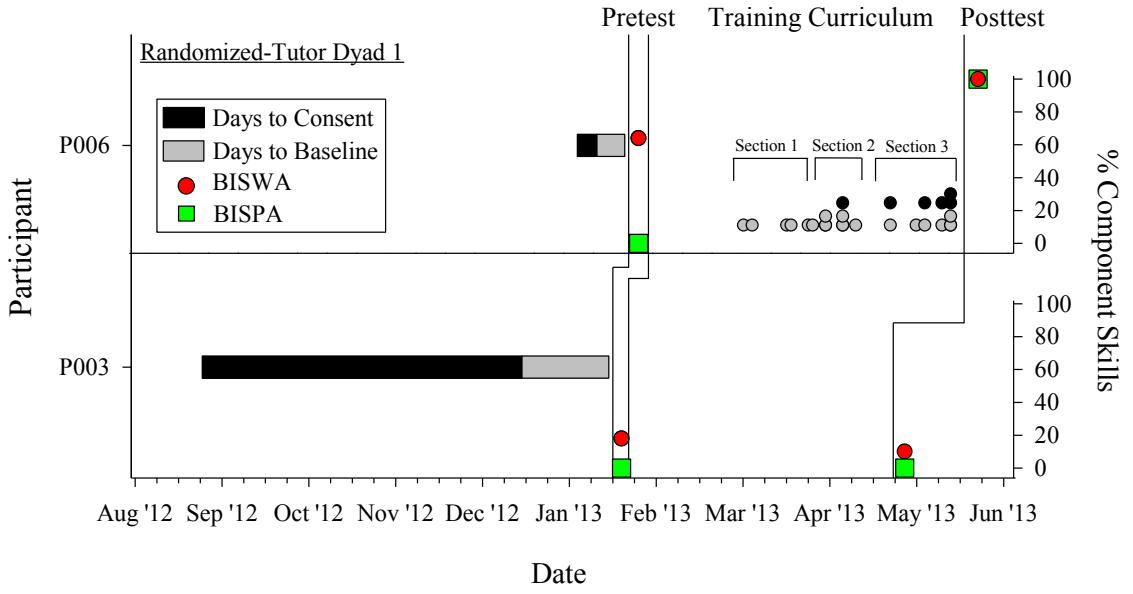
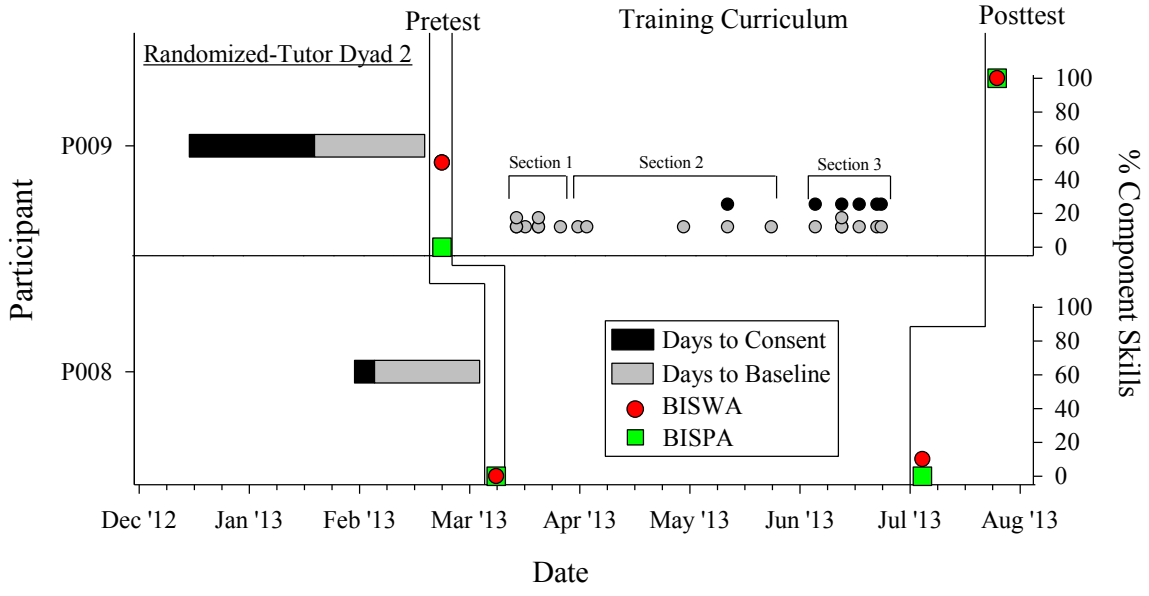


Figure 5.



b. Single-Subject Design. For tutors that withdrew from the randomized clinical trial, we are evaluating the effects of the technology-enhanced training within a single-subject experimental design. This evaluation is currently being conducted with three tutors.

c. Social Validity Outcomes. Following completion of the technology-enhanced tutor training, we ask tutors to provide closed- and open-ended responses (ratings and comments) regarding their acceptability of the web-based technology, content covered during training, interactions with the consultant and scheduling, and overall impression of the training program. In Table 1, we report results for the one tutor who has completed the questionnaire; the tutor used a 7-point Likert scale with the following ratings: 7 = strongly agree, 4 = no opinion, 1 = strongly disagree.

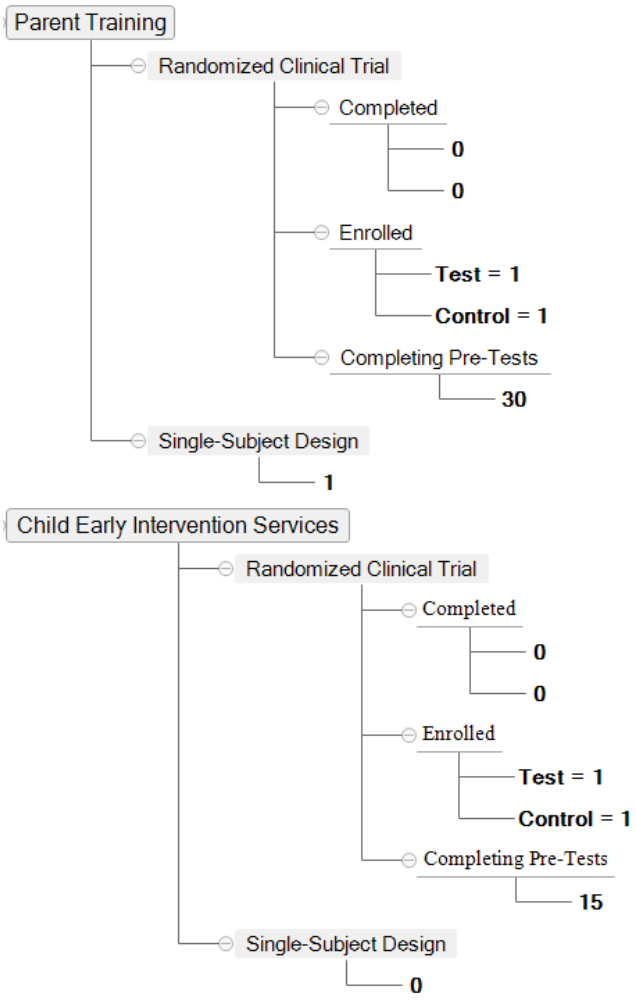
Table 1
Social Validity Assessment and Results for Technology-Enhanced Tutor Training

Questions	Ratings
Web-Based Technology	
1. *Prior to interacting with my consultant and conducting virtual meetings, you were asked to setup some technology*. I was satisfied with the process of accessing the GotoMeeting or Adobe Connect meeting room and starting my audio and webcam?	7
2. *We conducted virtual meetings, using either Gotomeeting or Adobe Connect, to review the goals for the upcoming week and provide a status update.* I was satisfied with the reliability (e.g., consistent internet connection) and the audio and video quality of these virtual meetings.	7
3. *Virtual meetings were also conducted for teaching during role-plays.* I was satisfied with the reliability (e.g., consistent internet connection) and the audio and video quality during the role-plays.	7
4. *We provided the modules and quizzes through Blackboard's software platform.* I was satisfied with Blackboard as the method to deliver the modules and quizzes.	5
Content Covered during Training	
5. *Each module covered the core content of a given topic*. I was satisfied with the amount and type of information covered in the modules.	7
6. *We conducted several role-plays throughout the training and each role-play covered a different topic.* I was satisfied with the role plays as a component of training (i.e., an opportunity to practice the skills and receive real-time feedback).	7
7. I was satisfied with the quality and organization of these modules?	7
8. I was satisfied with the amount that I learned during the training.	7
Interactions with your Consultant and Scheduling	

9. *During role-plays and throughout the training program, you had the opportunity to ask your consultant questions about the content of the curriculum or rationale for certain skills during the role plays.* I was satisfied with my consultant's ability to answer my questions.	7
10. I am satisfied with the interactions that I had with my consultant (e.g., time to respond to questions, weekly updates).	7
11. *The training program was arranged so that you could proceed at your own pace.* I was satisfied with option of completing the program at my own pace	7
12. I was satisfied with the flexibility of scheduling meetings and role plays.	7
Overall Training Program	
13. *During role-plays and throughout the training program, you had the opportunity to ask your consultant questions about the content of the curriculum or rationale for certain skills during the role-plays.* I was satisfied with the consultant's ability to answer my questions.	7
14. Overall, I was satisfied with this program.	7
15. Would you recommend this type of web-based instruction to other individuals who are not able to receive on-site instruction?	**Yes**

4. *Recruit, pretest, and train and treat 5 parents and 5 children in the technology-enhanced test group and 5 parents and 5 children in the waitlist-control group across two cohorts.* Schematic 2 details the progress for the technology-enhanced parent training and in-home early intervention for children with autism (Experiments 1 & 3).

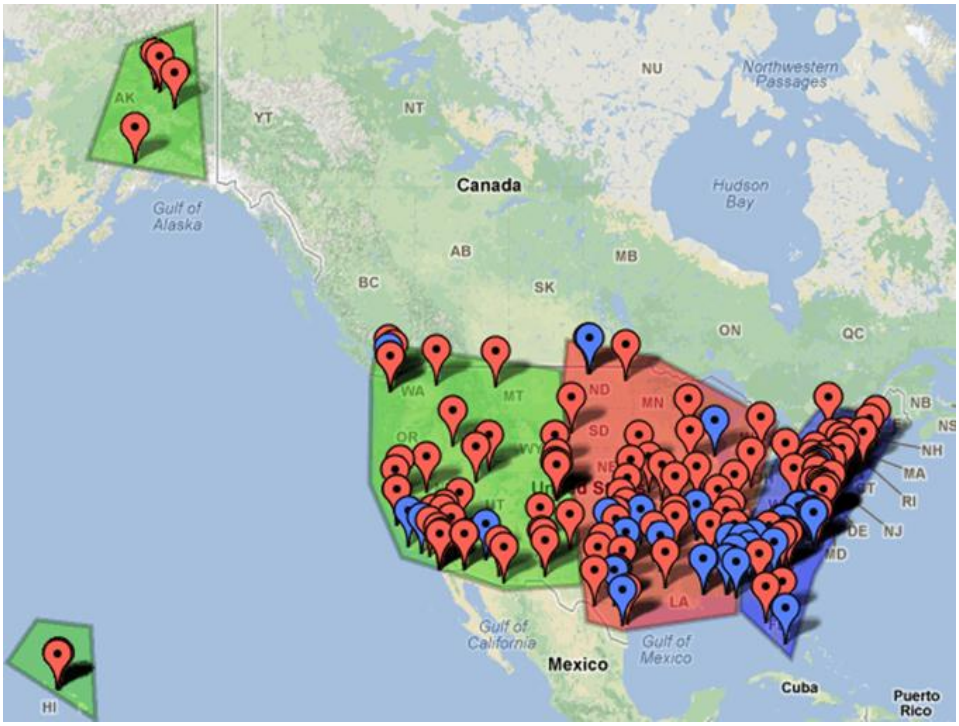
Schematic 2. →



a. Randomized Clinical Trial. We currently have one parent and one child randomized to the test and waitlist-control groups. However, due to recent efforts to disseminate information about our program, we have 30 parents and 15 children at various stages of completing the pre-tests and pre-assessments required prior to randomization. This notable increase in participants is likely due, in part, to the recruitment effort summarized below.

i. Communication with EFMP coordinators. We have created a visual map of all the EFMP coordinators in the United States in Figure 6. For each pin on the map, we have identified the contact information of the EFMP coordinator and the associated military base. The red pins denote bases that have returned our phone calls or emails and have offered to distribute our materials to military families that may benefit from our services. The blue pins denote bases that have not returned our communication attempts. As indicated by the number of red pins, we have successfully contacted and distributed our recruitment materials to over 77% of the bases.

Figure 6.



ii. We delivered a webinar on the grant to 26 EFMP coordinators and medical personnel in the Navy, which was arranged by EFMP-Analyst-Commander Lisa Davis; we also sent our flyers and information papers to 10 Regional Case Liaisons. All attendees expressed enthusiasm for the program and its potential for improving the lives of military families that they serve.

iii. We conducted a webinar for medical personnel and EFMP coordinators at Tinker Air Force Base.

iv. Beverly Boaz, SME Senior Consultant in BUMED, worked with us to publish information about the grant in Health Care Operations Newsletter, which is distributed monthly to hundreds of military families.

v. We spoke with Elizabeth Leath, who is a Family Support Specialist at the Airman & Family Readiness Center in the United Kingdom. In addition, we conducted a webinar with the EFMP coordinator and medical personal at the military base associated with RAF Lakenheath in the United Kingdom. Although we would be limited in providing in-home early intervention services abroad, there is strong demand for parent-training services.

vi. We have spoken with the Association for University Centers on Disabilities (AUCD) to disseminate information about the grant. We have spoken with several medical personnel who are responsible for diagnosing children with autism; as a result, this may lead to families learning about the grant and contacting us. We are working with Leadership Education in Neurodevelopment and Related Disabilities (LEND) programs to share information about the grant.

vii. As another means for military families to learn about the grant, we have asked military-housing communities near bases to distribute our recruitment materials. Of the 149 bases that we have contacted, 49 responded to our requests and have distributed our materials.

viii. We have contacted 244 military veteran associations or centers throughout the United States to distribute our recruitment materials because they may know of military families with a child with autism. 130 centers have agreed to distribute and post information about our grant.

ix. We have contacted the Department of Defense Education Activity (DoDEA) because we hope to disseminate information to military schools who may serve children with autism. In addition, we have contacted preschool and early-intervention programs near military bases in the case that the teachers may know of military families who could benefit from participating in the grant. We are also working with Centers for Excellence in Disabilities in different states to spread information about the grant.

Key Research Accomplishments

We have completed evaluations for the technology-enhanced parent-training (Experiment 1) and tutor-training (Experiment 2) curricula using single-subject experimental designs. All results supported the efficacy of the web-based teaching procedures. The initial results from the randomized clinical trial for training tutors also supported the efficacy of the web-based teaching procedures for improving performance on both primary dependent measures: The differences between the test and control groups approached statistical significance for the BISWA ($p = .066$) and the differences for the BISPA were highly significant ($p < .0001$). Given our recent recruitment efforts, we plan to initiate the randomized clinical trials for technology-enhanced parent-training (15 assigned to the test group; 15 assigned to the control group) and in-home early intervention services (7 assigned to the test group; 7 assigned to the control group).

Reportable Outcomes

We have presented the preliminary results shown in Figure 3 above (training ABA tutors to conduct a preference assessment using web-based training) at a national conference, the Annual Conference of the Association for Behavior Analysis International. We are currently writing a paper describing this study to be submitted to the *Journal of Applied Behavior Analysis* for consideration for publication.

Conclusions

Although the results of our preliminary studies and the early results of the randomized clinical trial are encouraging, it is premature to draw any firm conclusions at this juncture of the award.

References

Not applicable.